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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/865,546

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Taiji Noda

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07/01/2002

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EXAMINER

SARKAR, ASOK K

ART UNIT

PAPER NUMBER

2829

DATE MAILED: 07/01/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/865,546

Applicant(s)

NODA, TAIJI

Examiner

Asok K. Sarkar

Art Unit

2829

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 May 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) 10-27 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 May 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2,3.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Election/Restrictions

1. Applicant's election of Group I claims 1 - 9 in Paper No. 6 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).
2. Claims 10 – 27 were withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected Group II claims, there being no allowable generic or linking claim. Election was treated as **without** traverse in Paper No. 6.

Specification

3. The disclosure is objected to because of the following informalities:

The phrases such as "... pocket heavily-doped" and "... extension heavily-doped" should be replaced with "... pocket region of heavily-doped" and "... extension region heavily-doped" throughout the disclosure including abstract, specification and the claim language.

Appropriate correction is required.

4. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: "Method for fabricating semiconductor device by using large mass number dopants".

Claim Objections

5. Claims 4 and 8 are objected to because of the following informalities: The

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phrases such as “ ... pocket heavily-doped” and “ ... extension heavily-doped” should be replaced with “ ... pocket region of heavily-doped” and “ ... extension region heavily-doped”.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

7. Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by Burr, US 6,093,951.

Burr teaches a semiconductor device comprising a heavily doped diffusion layer Formed by using dopant ion In of relatively large mass number in column 14, lines 35 – 41 in an epitaxial region of silicon included in at least an upper portion of the epitaxial silicon substrate in column 5, lines 45 – 50 and in column 15, lines 48 – 50.

8. Claims 1 and 3 are rejected under 35 U.S.C. 102(e) as being anticipated by Burr, US 6,093,951.

Sultan teaches a semiconductor device comprising a heavily doped dopant ion,

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In, of large mass number (see column 6, lines 24 – 25) in an epitaxial region included in the upper part of the epitaxial semiconductor substrate in column 7, lines 10 – 12.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Burr, US 6,093,951.

Burr teaches doping with In at levels of 10^{13} cm^{-2} and over $5 \times 10^{13} \text{ cm}^{-2}$ level with n-type ions such as As and Sb and fails to expressly teach doping with In at dose over $5 \times 10^{13} \text{ cm}^{-2}$.

However, it would have been obvious to one with ordinary skill in the art at the time of the invention to form the diffusion layer with In instead of Sb since heavy ions such as In and Sb have smaller diffusion coefficient.

11. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Burr, US 6,093,951 in view of Koyama, US 5,177,569.

Burr fails to expressly teach epitaxial region having $\langle 110 \rangle$ - oriented zone axis.

Koyama teaches the advantages of dopant implantations in single crystal (110) plane orientation in between column 6, line 63 and column 7, line 24.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to form the diffusion layer in Burr's device with In and replace the

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substrate having $\langle 110 \rangle$ - oriented zone axis so that the epitaxial layer is formed with $\langle 110 \rangle$ - oriented zone axis since the transistor characteristics will be further enhanced as taught by Koyama in addition to being enhanced by using dopant In.

12. Claims 4 – 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Admitted prior Art (APA) in view of Burr, US 6,093,951 and Koyama, US 5,177,569.

The APA teaches a MIS device with a gate electrode above a semiconductor substrate, a source/drain diffusion layer of first conductivity type, an extension zone of heavily doped diffusion layer and a pocket region doped with with a second conductivity type dopant under the extension zone of heavily doped diffusion layer.

The APA fails to expressly teach heavy doping ($> 5 \times 10^{13} \text{ cm}^{-2}$) by In, extension zone of heavily doped diffusion layer of Sb ion and epitaxial region with $\langle 110 \rangle$ - oriented zone axis.

Burr teaches heavily doped pocket region with In and heavy doped diffusion layer with Sb in an epitaxial region as explained above in rejecting claims 1 and 3.

Koyama teaches the advantage of epitaxial region with $\langle 110 \rangle$ - oriented zone axis as explained above in rejecting claim 2.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify the teachings of APA and build the device by growing an epitaxial region with $\langle 110 \rangle$ - oriented zone axis or use a substrate with $\langle 110 \rangle$ - oriented zone axis to grow epitaxial layer as taught by Koyama and use heavily doped pocket and extension regions with ions such as In and Sb of large mass numbers as taught by

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Burr so that the size and area of the doped regions can be accurately controlled to enhance device performance.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 703 308 2521. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael J. Sherry can be reached on 703 308 1680. The fax phone numbers for the organization where this application or proceeding is assigned are 703 308 7722 for regular communications and 703 308 7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 4918.

Asok K. Sarkar
June 24, 2002



**MICHAEL SHERRY
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